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THAILAND NATIONAL PROGRAM

OF THE

EARTH RESOURCES TECHNOLOGY SATELLITE

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Secretary-General

National Research Council

Bangkok 9, Thailand

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" An Account of

Thailand National Program

of the

Earth Resources Technology Satellite "

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The Thailand National Program

of the

Earth Resources Technology Satellite

Kaew Nualchawee **

1. Background

The Thailand National Program of the Earth Resources Technology Satellite originates from the General Assembly of the United Nations in September 1970 at which the United States representative declared to other countries the importance of utilizing space technology. He also informed the General Assembly that the United States would be happy to disseminate information obtained by the Earth Resources Technology Satellite (ERTS), the first of which to be launched by the United States at an approximate cost of $100 million, would travel around the world on a polar orbit. In April 1971 Mr. F.Z. Kutena, an expert on land development and water resources of the Food and Agriculture Organization of the United Nations, informed the National Research Council (NRC) of Thailand that should Thailand wish to survey her natural resources by means of the satellite when it travels over Thailand, the United States could make arrangement for the satellite to photograph her resources without charge and would also be ready to provide assistance in interpreting the photographs taken by the satellite.

After the NRC and other related Thai government agencies had considered Mr. Kutena's proposal, they unanimously agreed that Thailand still needs a considerable amount of data on natural resources, and application of the satellite technology would yield immediate, accurate information to meet this urgent need. The NRC therefore sought the approval of the cabinet to collaborate with the National Aeronautics and Space Administration (NASA) on the United States ERTS Program. On September 14, 1971 the cabinet appointed a coordinating committee on the Thailand National Program of ERTS consisting of twenty concerned government agencies having Dr. Pradisth Cheosakul, Secretary-General of the NRC, as the chairman.

The coordinating committee therefore appointed a working sub-committee with Dr. Boon Indrambarya, Director of the Environmental and Ecological Research Institute, the Applied Scientific Research Corporation of Thailand as its leader and Mr. Joseph Morgan from the Agency for International Development as its adviser. The working sub-committee prepared the Thailand National Program of ERTS for submission to the NASA which later on approved Thailand's participation in its resources survey.

** Mr. Kaew Nualchawee, an Experimental Officer of the Environmental and Ecological Research Institute, Applied Scientific Research Corporation of Thailand, is a secretary of the Working Sub-Committee. The Thailand National Program of ERTS.

II. Objectives

The Royal Thailand Government (RTG) submitted a request to NASA to participate in the ERTS program based on the following statement of objectives:-

To promote satellite data evaluation programs by existing government institutions in order to evaluate the extent to which ERTS data could be beneficially applied in various sectors of economy to assist in the difficult task of acquiring data needed for resources inventory, planning, and management at the national level.

To introduce to Thailand space technology for resources survey and management.

To improve and add to information on resources needed for specific development projects of national planning.

To develop training facilities and offer courses to other countries and in the long projection.

To develop a modern National Resources Survey and Data Bank Center.

III. Expected Benefits from ERTS

Participating Government Departments have defined objectives specific to their areas of responsibility that will contribute to evaluation of applicability in the various disciplines of importance. Following is a list of various disciplines and their expected benefits:-

a) Agriculture

As an agricultural country, Thailand urgently needs quantitative information on planting areas and production of major crops of the country. This is mainly to assure adequate production for the ever increasing population as well as export purpose. The conventional method of obtaining information and collection statistic is time consuming and unreliable which may, in many occasions, lead to a wrong interpretation of the nation's economic situation.

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Because of the unique property of the ERTS in that it covers a synoptic view of an area of 185 x 185 kilometers and a repetitive fashion of coverage gives an impression that it has more coverage accuracy and records timely changes of terrain information. The Agriculture discipline could expect to make use of the ERTS in the following ways:-

1. To set up crop calendars, showing cycles of major crops of the country.

2. To estimate the area of planting of some major economic crops.

3. To estimate the area damaged by natural phenomena and the production of the major economic crops.

4. To identify the changes in land area used for production of some major economic crops.

5. To estimate the probable yields of major economic crops (with support from ground truth data).

b). Forestry

Thailand has an area of about 514,000 square kilometers. According to the National Economic development plan, it is required to reserve about half of the total area for National Forest Reserves. At present, the forest condition has changed all over the country due to many reasons, such as damage by natural phenomena, shifting cultivation, illegal cutting and illegal possenssion of forest land. These occurrences usually take place in remote areas where access by authorities is very difficult, if possible. In addition to the aforementioned importance, the need to set up boundaries for the National Forest Reserves is also very urgent. This work has always been in conflict with other departments whose responsibilities are to make use of land for other development purposes.

The Royal Forestry Department and the Faculty of Forestry of Kasetsart University realize the potential importance of the ERTS program and have confidence that ERTS should provide a basis for them to achieve the following objectives within a reasonable period of time:-

1. To detect forest and non-forest areas of the whole Kingdom.

2. To estimate the present and future forest production.

3. To identify the changes in forest land use.

c) Oceanography

Remote sensing is an advanced science and technology which could benefit fisheries and oceanography. Benefits from ERTS output for fisheries would be direct, as far as benefit to the aquaculture program and the economy, and would provide data toward some of the objectives of the Department of Fisheries:-

1. Thermal readings for water surfaces for various water bodies including the Gulf of Thailand as well as the coastal areas off the Western shore of the peninsular Thailand.

2. Waterbody movements, so that the circulation patterns of such areas as the Gulf of Thailand may be known.

3. Appearance of pollutants of varying concentrations and types in run-off, effluents and on the surface, i.e. oil slicks, or seeps.

4. Presence of planktonic blooms and extent of such blooms, since they are primary producers upon which all economic considerations of aquatic resources are reliant.

This type of data could be collected with existing methods, but it would be years before the interpretations could be given, and it would be financially impossible, and above all it will be out of date by the time the interpretation is completed.

d) Geography/Demography/Cartography

Thailand, being an agricultural country urgently needs information concerning present land use and area harvested. This information together with information relative to land capability, soil suitability, crop yields and managenent requirements is needed for planning of the total agricultural program of Kingdom.

With this information, agricultural planning could be based on areas of land available for crop production and location of each crop on soils and in areas best suited for most efficient production. More accurate estimates of production for each crop could be made, and modification and adjustments to meet changing needs and market conditions could be made more efficiently. The land use mapping program in Thailand intends to map out various types of present land use of the entire Kingdom with a scale of 1:1,000,000 emphasizing principal land uses, and forest areas. With more experience in interpretation of ERTS type data, it is expected that the land use mapping program will achieve the following goals:-

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1. Acceleration of the program to get land use maps in reasonable period of time.

2. Permit updating of existing maps.

3. As the ERTS acquires information at a regular interval it is possible to repeat the observations as needed for identification of changes in tonal signature, which together with a crop calendar will permit identification of various crops.

e) Geology

It has been accepted as a fact that minerals of any origin play an important role in the nation's economy. Government of as well as private organizations have been surveying and exploring mineral resources. The Department of Mineral Resources is a government organization that deals directly with mineral resources survey. The Department of Mineral Resources is responsible in addition to its major activities in geological mapping, for mining exploration and ground water investigation. The Department expects to benefit from the ERTS data more accurately and faster than a conventional aerial photography. Additionally, the multispectral data obtained from ERTS could be made into color composite data to enhance different geologic features which will make interpretation easier and more accurate. The projects expected to be undertaken are:-

1. Photo map of the Kingdom of Thailand at a scale of 1:1,000,000 which will be made available to all agencies concerned.

2. Basic geological mapping at a scale of 1:250,000 with the following information:

- 2.1 Lithologic mapping, - discrimination of major rock units.
- 2.2 Structural lineation of Thailand, mineralization zones, major faults, major structures, and structure of petroleum reservoirs.
- 2.3 Underground water mapping, and
- 2.4 Morphology

f) Hydrology and Meteorology

Water resources development projects were initiated in Thailand more than half a century ago. The projects are designed mainly for irrigation, flood control, water conservation, power generation, waterway transportation and other areas of development that have to do with the population's well being. Hydrological and meteorological information is an important parameter from which the development project accomplishes its goal. If data collection and analysis are accurate and up-to-date, the development plan would be more perfect.

Efficient operation of these projects, which demand timely information on various phases of the hydrological cycle within the watershed area, can be improved using ERTS data. For example, soil moisture condition of the basin floor and the upper watershed may be assessed more accurately. Correct correlation between basin rainfall and river runoff may be determined using such information, on which flood forecasting procedures may be developed, and flood warning and flood damage minimization can be properly managed.

The National Energy Administration (NEA) , the Royal Irrigation Department (RID), and the Meteorological Department realize the fact that hydrological and meteorological information contributes a great deal to success of a development project. They set up data collection stations throughout the entire country for that reason. The collected data will be supplemental to that obtained from the ERTS. It is expected that the information from ERTS would furnish a source of improved data for operational purposes.

1. Determination of flood areas within the major river valleys and in the Central Plain areas. Such determination will include the boundaries as well as the flooding depths. Results will be applied to the estimation of flood damage.

2. Identification of changes of hydrological parameters within the river basins that may be useful in forecasting the river runoff at various river reaches.

IV. Scope and Procedure

Upon acceptance from NASA to participate in its Earth Resources Technology Satellite Program, the Thailand National Coordinating Program of Earth Resources Technology Satellite was set up and chaired by the Secretary-General of the National Research Council, for policy and guidance. The National Research Council coordinates the participation of all interested Thai Departments, assisted by the Applied Scientific Research Corporation of Thailand. An interdepartmental Task Force of Thai scientists was organized for program development and implementation. ERTS data has been transmitted to Thailand from NASA regularly for analysis and interpretation in the fields of interest of the participating agencies. Research, development, and findings are reported and compiled. Scope of work of the program follows:-

1. Accomplishments

The Earth Resources Technology Satellite Program utitizing remote sensing technology is relatively new to Thailand. The Royal Thai Government recognized the need for trained manpower to interpret and utilize the satellite output in its various departmental programs and requested USOM for assistance in providing necessary training. The remote sensing training course for improving Thai or third country national resources management and development were arranged:

1.1 Training abroad

(a) Mr. Sathit Wacharakitti of the Faculty of Forestry, Kasetsart University was the first Thai scientist who received training from the University of Michigan in the field of Remote Sensing.

(b) A group of Thai scientists/administrators received UNDP/AID grant to participate in the NASA's ERTS Program during January 24 - February 12, 1972 in the United States.

The group comprised:

Dr. Boon Indrambarya of the Applied Scientific Research Corporation of Thailand,
Dr. Chamni Boonyopas of the Royal Forestry Department, and
Mr. Smarn Panichapongse of the Land Development Department.

(c) With the assistance of the United Nations Development Program, the National Research Council sent a group of six Thai scientists to the United States of America for training. They are from the participating departments:

The Royal Forestry Department,
The Department of Land Development,
The National Energy Administration,
The Agricultural Technical Department,
The National Statistical Office, and
The Applied Scientific Research Corporation of Thailand

They received their training at Purdue University in the Survey of natural resources by means of satellite, and interpretation techniques using automatic data processing.

1.2 Training in the country

With additional support from the Agency for International Development it was possible for the NRC and USOM to organize a remote sensing training course in Thailand. The training course was conducted in two phases:

a) First phase training

The six week training course in remote sensing was held during January 4 - February 14, 1973. There were 57 Thai participants from participating Thai government agencies, 4 participants from the committee for Coordination of Investigations of the Lower Mekong Basin, and 10 participants from member countries of the Economic Commission for Asia and the Far East (ECAFE). Instructors were experts from the United States Geological Survey and some universities in the United States. The six Thai scientists who were trained in the United States served as assistant instructors.

b) Second phase training

Under the same arrangement, a 4 week training period was held during May 20 - June 20, 1973. The purpose was to follow up progress or results of phase one training with regard to understanding and approaching remote sensing problems, especially interpretation techniques of the ERTS data. It was also intended for Thai scientists to exchange ideas and problems with the team of U.S. remote sensing experts. During the training period, many lectures concerning potential applications of ERTS data to the nation's natural resources were delivered to many groups of people in various government departments by the U.S. team of experts. The lectures drew many enthusiastic responses from many people, including high ranking officials as well as students.

1.3 Public Lectures

The USGS team of experts, after departure from Thailand in June 1973, stirred up interest in many sectors of the community, including students in Bangkok, relative to the application of the ERTS-1 images of Thailand. Through the management of the Children's Hall (SALA WAN DEK), of the Ministry of Education, some 20 lectures on the topic were delivered by members of the Working Sub-Committee. One lecture had an audience of about 200 high school students. The SALA WAN DEK authorities also had 2,500 copies of a black and white photo map of Thailand reproduced at a scale of 1:4,500,000 from the original MSS photo mosaic of Thailand at the scale of 1:1,000,000 to hand out to students and schools concerned for educational materials.

1.4 Research, Development and Service Project

The Applied Scientific Research Corporation of Thailand, being a focal point for a cooperating program, such as the Thailand National Program of the Earth Resources Technology Satellite, and an action agent for the National Research Council on the same program has to provide service for users, in addition to its own research and development program. Many research, development and service projects were initiated, some of which are:

- basic calculations of relationships between Thailand parameters and those of the ERTS-1,
- modification of chip mounting frame for 70 mm. positive transparencies to fit the 4-channel projector/viewer,
- production of additional data products which include diazochrome color transparencies, 35 mm. black and white and color slides, printing and enlarging service, Vugraph transparencies,
- line of sight limit, Bangkok to ERTS-1 orbit, and a consideration for setting up of a receiving station in Bangkok.

The latter was considered because of the usefulness of a data receiving station capable of receiving transmitted data directly from the satellite, when it is within the line of sight. A data receiving station, similar to those in Canada and Brazil, could be erected in Bangkok and could supply data to Thailand and surrounding countries. The station would be capable of receiving image data in real-time when the satellite passes over areas within a circle with approximately a 3,000 kilometers radius centered on Bangkok. Processing facilities will be required for production of magnetic tapes. conversion of tapes to photographic images, and reproduction and dissemination of the images.

It is clearly evident, with the growing experience of the Royal Thai Government and the geographic location of Bangkok, that a data receiving station serving all Southeast Asia and surrounding countries could effectively be operated at Bangkok. (See attached map)

V. Future Plan

At present, the Thailand National Program of Earth Resources Technology Satellite does not have a separate operating base (office), but shares partly with ASRCT and partly with NRC. The Working Sub-Committee meeting agreed that the program should set up a separate office to serve as a center for information in remote sensing research at the national level. The Working Sub-Committee advised the Coordinating committee for further action and the request for approval has been submitted to the Office of the Prime Minister by the NRC. The condition and procedures include:-

1. The Thailand National Program of ERTS Office

The name of the office was proposed to be "ERTS Coordination/ Research Center" and its functions will include:

- To deal with NASA regarding receiving, maintaining, cataloging, and reproducing ERTS data.
- To procure and maintain specialized equipment as might be acquired from various sources as the project progresses.
- To act for NRC in dealing with both NASA and participating agencies regarding all aspects of remote sensing that has to do with the ERTS program.
- To present proposals, reports of results, findings to NASA and other concerned organizations.
- To coordinate closely with all participating agencies so that the National Program of ERTS could be implemented and the goal achieved.

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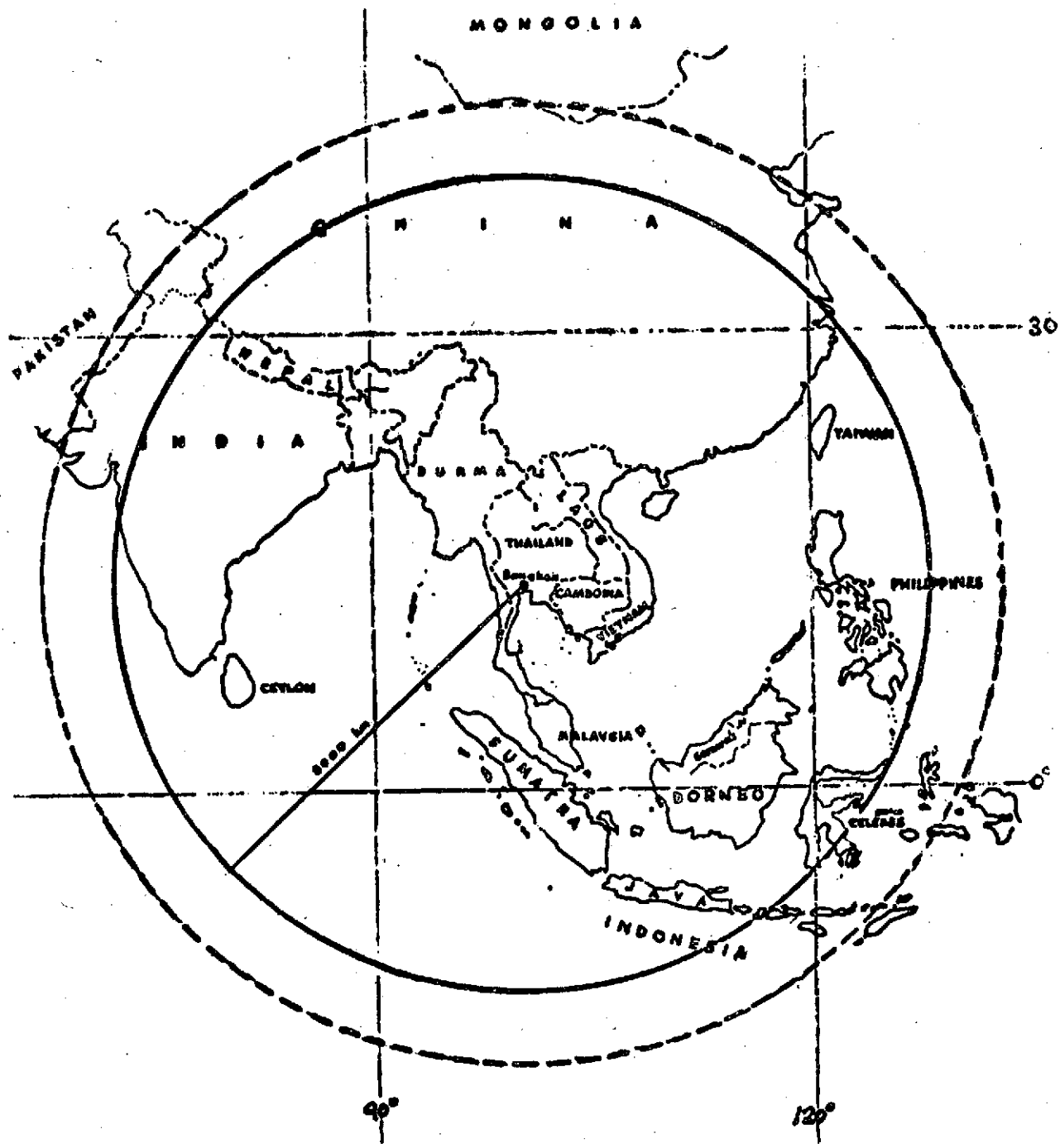

Service area for an ERTS data receiving station located at Bangkok. The inner circle indicates a conservative 3000 Km radius, within which reception would be reliable. The outer circle (broken line) represents the distance to the horizon, about 3500 km, from the ERTS-1 satellite.

2. Personnel

Minimum number of personnel for the center as requested consists of:

Position	Number
Program Coordinator	1
Assistant Program Coordinator	1
Technical Officers	2
Technicians/Specialists	2
Secretaries/Typists	2

It is hoped that, if the proposal for setting up of the ERTS Coordination Research Center gets approval from the cabinet, the number of personnel will increase as needed by the growing of the program in the future.

3. Budget

The National Research Council, by the advice of the National Program of ERTS, submitted a request for budget to the Office of the Prime Minister on July 17, 1973. The annual budget requested are 2,425,220 Baht for the fiscal year 1974, and 2,094,670 Baht each year thereafter.

Because of expected benefits from ERTS in the planning and management of the nation's natural resources (mentioned under III), and experience gained during the course of investigation by participating agencies, it is hoped that Thailand will benefit from ERTS as a whole and that the request should be approved.

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3 August 1973